


## MEMORANDUM

**Date:** 12 May 2017  
**To:** Mike Luecker, P.E., USDA-RD Community Programs  
**Subject:** Clarifying Information for Evaluation of the Hopi Arsenic Mitigation  
Project (HAMP) Regional Water System Plan

USDA-RD comments which were noted during the 4 May 2017 USEPA-R9 HAMP Conference call are addressed in the document entitled Life Cycle Cost Analysis and Comparison of Arsenic Mitigation Alternatives: HAMP Groundwater System and Village Arsenic Treatment Systems. To better compare the HAMP regional water system plan with a localized arsenic treatment scenario, it is recommended that the Life Cycle Cost Analysis (LCCA) be reviewed because that document supports and supplements the HAMP design and cost data as presented in the HAMP Preliminary Engineering Report (PER).

The following bulleted statements and narratives are provided for the purpose of emphasizing specific HAMP regional water system design and conceptual elements in order to promote a more accurate understanding and evaluation of the overall HAMP plan.

- There are four separate and distinct water systems which are intended to be served by the HAMP regional water system. Each of the water systems is currently served by an aging well or wells which produce water which exceeds the federal Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) of 10 parts per billion (ppb) for arsenic (As). This fact is important because the typical municipal water supply well life-span is approximately 40-years on the high-end. Thus, some of the existing wells are fast approaching their expected useful life so that consideration of localized As removal treatment options should also include replacement wells, system connection piping, up-dated control systems, new pumps and motors, and depending on location, new pump-house facilities and water storage tanks (WSTs).
  - Shungopovi Village (40-year old existing well in service)
  - Lower Sipaulovi/Mishongnovi (30-year old existing well in service)
  - Upper Sipaulovi/Mishongnovi (30-year old existing well in service)
  - First Mesa Consolidated Villages (two 30-year old wells in service and one 28-year old well in service).

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- To provide localized arsenic (As) removal treatment for the purpose of returning the four (4) referenced public water systems to SDWA compliance with the As MCL would require separate treatment facilities in each of the four villages. In First Mesa, a dedicated \$1.1M transmission main between Well Nos. 5/6 and Well No. 8 in First Mesa or, alternatively, a fifth (5<sup>th</sup>) treatment facility at the Well 5/6 well-site would also be required.
- Per Mr. Tim Bodell, Director of the Hopi Public Utility Authority (HPUA), there is currently a high likelihood that the extension of electrical power to the existing Turquoise Trail Wells will be accomplished under a \$1.1M agreement between the Hopi Tribal Power and Energy Committee and the Navajo Tribal Utility Authority. The cost of this required infrastructure is listed in the HAMP PER as \$1.8M but should no longer be included as HAMP funding application budget line-item. Instead, this soon-to-be sunk cost of \$1.1M will serve the HAMP regional water system and promote local development in areas which are proximal to the Turquoise Trail Wells. Calculated HAMP LLCA benefit/costs will thus further favor the regional water system plan as compared to the individual village treatment scenario.
- Peak design demands in Section 5.3 of the PER are used for the sizing of facilities (e.g. pipes, wells, etc.), but not for the present worth LLCA of alternatives. Section 5.1 of the LCCA document describes the present value calculation as follows:

"Determination and analysis of the life cycle costs of the HAMP system and the Village arsenic treatment systems is based on present value. The evaluation follows the guidance in the interagency engineering report for evaluating life cycle costs for IHS 86-121 projects, except as noted. Present value includes future costs in today's (Year 2015) dollars. Future costs are converted to today's dollars with a 'discount' rate based on the latest OMB rate which includes inflation."

"The simplified calculation used herein includes capital costs and future renewal and replacement costs estimated in today's dollars. These costs are not inflated since application of the discount rate to the future inflated costs would result in the same cost as calculated today."

"Annual O&M costs are increased based on an increase in water demand of 1.8% per year. This is a simplification since not all O&M costs will increase with an increase in water production. However, it is applied uniformly between the two alternatives and represents an equal comparison. A uniform gradient series factor is used to calculate the average annual O&M cost for the 20 year present value analysis life with a 1.8% per year increase. The present value of this average annual cost for the 20 year period is then calculated at the latest discount rate of 3.6% (20 years, with inflation - OMB, Dec 2013)."

"Estimated salvage value is not included, but a remaining useful life value is determined to identify assets that have useful life and value at the end of the 20 year design life. This is based on the assumption that the selected water system will continue to serve the Villages for some time after 20 years, rather than being abandoned."

- The HAMP PER did not clearly illustrate the difference between average daily system demands and peak demands. The following table clarifies those values for actual 2013, assumed 2015, and estimated future 2035 demand flows. Table 2.1 of the Hopi Water System Strategic Plan corresponds to the assumed 2015 demand flows without peak values applied.

Water Demand Type	2013 Reported Annual Production Volume (gallons)	2013 12-hr. / 24-hr. demand (gpm)	2015 12-hr. / 24-hr. demand (gpm)	2035 12-hr. / 24-hr. demand (gpm)
Average	69,601,400	264 / 132	274 / 137	392 / 196
Peak Day	104,402,100	264 / 132	412 / 206	784 / 392

Year 2015 Peak Day = (2013 Annual Average Production)\*1.5\*1.018<sup>2</sup>

Year 2035 Peak Day = (2013 Annual Average Production)\*2.0\*1.018<sup>22</sup>

- With the knowledge that a 40-year 25% loan component to USDA-RD grant funding is a program requirement, it seems logical that a more realistic HAMP LCCA would extend for a 40-year period of time as well. Within that time-span, HAMP wells, pipelines and WSTs should not require replacement but As-removal treatment systems may require replacement several times over during that same 40-year time increment. From that perspective, LCCA analysis further supports the viability of a regional water system plan as opposed to the individual village treatment-system scenario.
- The proposed pumping rates which are listed in the HAMP PER appear to be mistakenly excessive. Based on those pumping rate values, the PER recommends 100-hp submersible well pumps and 60-hp booster pumps to move water from the Turquoise Trail Wells to the WSTs at First and Second Mesa. However, IHS design criteria does not utilize peak factors to size pumps, but instead only for pipeline sizing. This is because properly sized WSTs have enough storage capacity (2.5 times the average daily demand minus 18 hours pumping without the highest producing pump) to provide water for service connections during peak demand periods. In addition, pumps may be run for longer than 12-hours on peak days if necessary. Thus, recommended pumping rates and pump sizes in the PER should be re-evaluated during final detailed system design efforts.
- The Strategic Plan document (Table 2.1) presents average daily demands for the projected 2015 2<sup>nd</sup> Mesa water systems (Upper & Lower Sipaulovi/Mishongnovi and Shungopavi).

- Research, analysis, and evaluation of As-removal treatment alternatives (e.g. activated alumina, coagulation/filtration, ion exchange, lime softening, oxidation/filtration, membrane filtration, etc.) was conducted by GHD, Inc., and those results are summarized in the LCCA document. The GHD effort was comprehensive and specific to the project area based on the historic performance of other facilities on the Hopi Reservation, specific water chemistries with respect to the selection of optimal Best Available Technology (BAT) applications, and overall costs. For that reason, we feel that the costs provided by GHD reflect a more specific, and consequently more accurate, cost analysis of expected Hopi Village As-treatment operations than the application of data from facilities operated in the Phoenix and southern AZ (i.e. non-rural areas with more access to O&M options/contracts) or in areas with water chemistries that are more naturally favorable to treatment processes.
- Under a local treatment scenario, it cannot be assumed that the five Hopi-Village wells which would require As-removal treatment are well-suited for the same BAT. This concept is illustrated by the differing As-removal technologies which are currently, and somewhat unsuccessfully, being employed at the Bureau of Indian Affairs/Bureau of Indian Education (BIA/BIE) Second Mesa Day School, the BIA/BIE Hopi High School and the BIA Keams Canyon Low Mountain Junction treatment facility which serves both the agency compound and a local village water distribution system. Each of those treatment systems employ a different BAT that was recommended by professional engineer consultants to the BIA/BIE because water quality and composition varies from well-to-well in the First and Second Mesa region(s).
- Under the HAMP regional water system plan, each individual village will be served by the Hopi Public Utility Authority (HPUA) distribution system through a master meter just upstream of each village WST. Water will then be distributed from the WST to residential and business connections within the village just as water is currently distributed within each village utility distribution system. Thus, the HPUA distribution piping is primarily serving as an alternative water source for each of the existing high [As] village wells. Under that plan, each village water utility will become a paying customer of the HPUA but each village utility will continue to own and operate its existing village infrastructure while also administering the business of water sales and distribution to its existing customer -base.
- At least two of the prospective HAMP/HPUA villages are currently able to meter water usage at the individual service connection level. However, for HPUA customer-billing purposes, the village master meter will serve as the basis for HPUA's monthly water usage billings because the village utilities are the HPUA customers, not the individual village residents. Individual customer usage charges will continue to be assessed locally within each village as they currently are by each village administration.

- With the HPUA regional water system in place, the USEPA will re-classify each HAMP-village water system as a "consecutive system". At that time, as is currently the situation, each system will continue to be identified under a unique Public Water System ID Number (PWSID). However, the financial burden of quarterly, annual and triennial sampling of local village wells for As, N, VOCs, SOCs, UCMs, etc. will no longer exist when/if those wells are physically/hydraulically disconnected from the village potable water distribution system.
- As consecutive public water systems to the HPUA, village power costs associated with running existing wells are reduced to zero, further saving limited village financial resources.
- Under the regional water system plan, some of the proposed chlorination facilities may not need to be operated because high-quality N-aquifer water from the Turquoise Trail Wells is anticipated to exhibit a low chlorine (Cl) demand. As "first-tap" customers on the recommended HPUA system, the Shungopovi and First Mesa systems are the most likely customers to not require re-chlorination of HPUA distributed water. This statement is based on IHS' experience with Navajo (NTUA) systems that pump from the N-aquifer and maintain Cl-residual throughout as much as 50-miles of system piping without supplemental chlorination being required.
- Pipe sizing to meet calculated 40-50 year system growth and area development is recommended for the regional water system design because the cost of up-sizing a pipeline diameter during initial construction is far less than replacing that piping at a future date. In addition, larger pipe-sizing reduces hydraulic head loss which translates directly into immediate energy conservation and operational cost savings.

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